

**USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY11 Final Performance Report
July 13, 2012**

Cover Page

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Fiscal Year:	FY11
USDA-ARS Agreement ID:	59-0790-7-080
USDA-ARS Agreement Title:	Integrated Management and Prediction of Fusarium Head Blight and DON in Winter Wheat.
FY11 USDA-ARS Award Amount:	\$ 11,805

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Award Amount
MGMT	Integrated Management of Fusarium Head Blight of Wheat in Nebraska.	\$ 9,756
MGMT	Effects of Local Corn Debris Management on FHB and DON Levels.	\$ 2,049
	Total ARS Award Amount	\$ 11,805

Principal Investigator

Date

* MGMT – FHB Management
 FSTU – Food Safety, Toxicology, & Utilization of Mycotoxin-contaminated Grain
 GDER – Gene Discovery & Engineering Resistance
 PBG – Pathogen Biology & Genetics
 BAR-CP – Barley Coordinated Project
 DUR-CP – Durum Coordinated Project
 HWW-CP – Hard Winter Wheat Coordinated Project
 VDHR – Variety Development & Uniform Nurseries – Sub categories are below:
 SPR – Spring Wheat Region
 NWW – Northern Soft Winter Wheat Region
 SWW – Southern Soft Red Winter Wheat Region

Project 1: *Integrated Management of Fusarium Head Blight of Wheat in Nebraska.*

1. What major problem or issue is being resolved relevant to Fusarium head blight (scab) and how are you resolving it?

The major problem being resolved is to more effectively manage Fusarium head blight (FHB, scab) and deoxynivalenol (DON) in winter wheat through integration of management strategies. In 2011, we compared the effect of a fungicide (Prosaro = prothioconazole + tebuconazole) application at early flowering to no fungicide application in four winter wheat cultivars with different levels of resistance to FHB (Jagalene, 2137, Harry, and Overland). The four cultivars were planted in the fall of 2010 on ground infested with chopped corn stalks. In the spring of 2011, corn-kernel inoculum of *Fusarium graminearum* was additionally applied to the soil surface of all plots. Prosaro was applied or not applied to plots of all four cultivars. Plots were inoculated with spores of *F. graminearum* (1×10^5 spores/ml) using a hand-pumped backpack sprayer 24 hours after fungicide application. Data on FHB index, yield, *Fusarium*-damaged kernels (FDK) and DON were obtained from the plots.

2. List the most important accomplishment and its impact (i.e. how is it being used) to minimize the threat of Fusarium head blight or to reduce mycotoxins. Complete both sections (repeat sections for each major accomplishment):

Accomplishment:

Disease pressure was low, resulting in low FHB index, DON, and FDK. The moderately resistant cultivar Overland had the lowest FHB index, DON, and FDK, and the highest yield. Although there were no statistically significant ($P = 0.05$) differences in FHB index, DON, and FDK between fungicide sprayed and non-sprayed plots within each cultivar due to low disease pressure, Prosaro fungicide generally reduced index, DON, and FDK and increased yield in three of the four cultivars, including a statistically significant increase in yield in the cultivar Harry.

Impact:

Data from the research will enable producers to choose the combination of cultivar and fungicide application that will be most effective in reducing FHB and DON. Losses from FHB and DON will be reduced and profits for producers will increase.

Project 2: *Effects of Local Corn Debris Management on FHB and DON Levels.*

1. What major problem or issue is being resolved relevant to Fusarium head blight (scab) and how are you resolving it?

Reduction or elimination of within-field sources of inoculum of *Fusarium graminearum* is the basis for cultural control measures such as crop rotation sequences in which cereals follow non-cereal crops. The goal of this USWBSI research project is to provide realistic estimates of ‘DON reduction’ that can be expected from cultural controls that reduce within-field inoculum sources. We utilized moldboard plowing of corn debris as a proxy for planting after a non-cereal crop to compare directly with wheat planted no-till into corn debris in commercial-scale wheat fields planted following grain corn harvest in Nebraska. Following corn harvest in 2010, replicated wide (60 ft) strips were moldboard plowed or left non-plowed prior to sowing wheat over the entire field with a no-till drill. Wheat in each strip was monitored for FHB and sampled for laboratory quantification of head infection by *F. graminearum* and contamination of grain by DON in 2011. FHB symptoms at soft dough stage were low to moderate. At crop maturity, a low percentage of wheat heads was found to be infected by *F. graminearum*. However, measurable DON (over 2 ppm in moldboard plowed and over 3 ppm in no-till strips) was found in grain. DON in moldboard plowed strips was 33% lower than in no-till strips.

2. List the most important accomplishment and its impact (i.e. how is it being used) to minimize the threat of Fusarium head blight or to reduce mycotoxins. Complete both sections (repeat sections for each major accomplishment):

Accomplishment:

There is a strong trend in year one data suggesting that inoculum from area atmospheric sources exerts a far greater effect than inoculum from in-field corn residue on the level of DON contamination in agricultural-scale strip plots, yet there was a small, but significant decrease in toxin in moldboard-plowed compared to no-till strips.

Impact:

Based on year one data, it appears that localized corn debris management prior to wheat planting results, on average, in fairly small reductions in FHB and in DON contamination in wheat. Regional atmospheric inoculum appears to play a far greater role in corn-dominated landscapes, thus prioritizing the need for resistant wheat varieties and effective fungicides as the main pillars of integrated management in corn production regions. A second year of experimentation in 2012 is being conducted to provide increased evidence of the magnitude of the effect of localized corn residue management on DON reduction. It should be noted, however, that while DON analysis has not yet been conducted on the 2012 samples, FHB occurred at very low levels in Nebraska in 2012 due to extraordinarily warm and dry conditions through flowering and grain filling. A third year of research may be needed to derive a realistic quantitative answer to the question being addressed.

Include below a list of the publications, presentations, peer-reviewed articles, and non-peer reviewed articles written about your work that resulted from all of the projects included in the grant. Please reference each item using an accepted journal format. If you need more space, continue the list on the next page.

Wegulo, S. N., Bockus, W. W., Hernandez Nopsa, J., De Wolf, E. D., Eskridge, K. M., Peiris, K. H. S., and Dowell, F. E. 2011. Effects of integrating cultivar resistance and fungicide application on Fusarium head blight and deoxynivalenol in winter wheat. *Plant Dis.* 95:554-560.

Hernandez Nopsa, J., Baenziger, P. S., Eskridge, K. M., Peiris, K. H. S., Dowell, F. E., Harris, S. D., and Wegulo, S. N. 2012. Differential accumulation of deoxynivalenol in two winter wheat cultivars varying in FHB phenotype response under field conditions. *Can. J. Plant Pathol. iFirst*: 1-10. DOI:10.1080/07060661.2012.695751

Willyerd, K. T., Li, C., Madden, L. V., Bradley, C. A., Bergstrom, G. C., Sweets, L. E., McMullen, M., Ransom, J. K., Grybauskas, A., Osborne, L., Wegulo, S. N., Hershman, D. E., Wise, K., Bockus, W. W., Groth, D., Dill-Mackey, R., Milus, E., Esker, P. D., Waxman, K. D., Adee, E. A., Ebelhar, S. E., Young, B. G., and Paul, P. A. 2012. Efficacy and stability of integrating fungicide and cultivar resistance to manage Fusarium head blight and deoxynivalenol in wheat. *Plant Dis.* 96:957-967.

Wegulo, S. N., Stevens, J. A., Byamukama, E. Z., Baenziger, P.S., and Bockus, W. W. 2011. Effects of winter wheat cultivars and Prosaro fungicide on FHB and DON. Pages 159-160 in: Proceedings of the 2011 National Fusarium Head Blight Forum. December 4-6, 2011. Hyatt Regency St. Louis at the Arch, St. Louis, MO.

Bergstrom, G. C., Waxman, K. D., Bradley, C. A., Hazelrigg, A. L., Hershman, D. E., Nagelkirk, M., Sweets, L. E., and Wegulo, S. N. 2011. Effects of local corn debris management on FHB and DON levels in seven U.S. wheat environments in 2011. Pages 119-121 in: Proceedings of the 2011 National Fusarium Head Blight Forum. December 4-6, 2011. Hyatt Regency St. Louis at the Arch, St. Louis, MO.

Willyerd, K., Bergstrom, G., Bradley, C., Dill-Mackey, R., Gross, P., Grybauskas, A., Halley, S., Hershman, D., Madden, L., McMullen, M., Milus, G., Osborne, L., Ruden, K., Salgado, J. D., Sweets, L., Wegulo, S., Waxman, K., Wise, K., and Paul, P. 2011. Uniform Fusarium head blight integrated management trials: a 2011 update. Pages 161-166 in: Proceedings of the 2011 National Fusarium Head Blight Forum. December 4-6, 2011. Hyatt Regency St. Louis at the Arch, St. Louis, MO.

Baenziger, P. S., Wegulo, S. N., Berzonsky, W., Bai, G., and Bakhsh, A. 2011. Breeding for scab resistant winter wheat: the thrill of victory and the agony of defeat. Pages 4-5 in: Proceedings of the 2011 National Fusarium Head Blight Forum. December 4-6, 2011. Hyatt Regency St. Louis at the Arch, St. Louis, MO.